

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

“ per litora spargite muscum,
Naiades, et circum vitreos considite fontes :
Pollice virgineo tencros hic carpite flores :
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas ;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui couchylia succo.”
N. Parthenii Giannettasii Ecl. 1.

No. 115. JULY 1867.

I.—*On the Annelid Genus Sphærodorum, Ærsted, and a new Representative of it, S. Claparedii.* By Dr. RICHARD GREEFF*.

[Plate I.]

UNDER the name of *Sphærodorum*, Ærsted, in 1844 †, founded a new genus of Annelids, characterized by the spherical form of the dorsal cirri, and by numerous papillæ standing on the fore part of the head. This was afterwards described by Johnston ‡ under the name of *Pollicita* (*peripatus*), and lately more carefully by Claparède §, and, with especial reference to the structure of the characteristic globular dorsal cirri, by Kölliker ||.

During a short residence in Dieppe last year, I found in the oyster-basin of that place a small Annelid which showed a near relationship to the genus in question, but at the same time differed from it in several points, and which, moreover, in other respects seems to me to present some very interesting pecu-

* Translated from Wiegmann's Archiv, 1866, pp. 338-351, by W. S. Dallas, F.L.S., &c.

† “Zur Classification der Annulaten,” Wiegmann's Archiv, 1844, p. 108.

‡ Annals & Magazine of Natural History, vol. xvi. p. 5, pl. 2. figs. 1-6.

§ ‘Beobachtungen über Anatomie und Entwicklungsgeschichte wirbelloser Thiere,’ Leipzig, 1863, p. 5, taf. 11. figs. 8-18.

|| “Kurzer Bericht über einige vergl.-anat. Untersuchungen,” Würzburger naturwiss. Zeitschrift, 1864, Band v. p. 240, taf. 6. fig. 1.

liarities that may render it worth a particular description *. I will revert at the conclusion of my communication to the characters common to this worm and to *Sphærodorum*, as also to those by which it differs therefrom, in order the better to effect a comparison between them.

The little animal measures scarcely 2 millims. in length, but is of considerable comparative breadth, attaining nearly 0·6 millim. in the middle regions of the body. It is narrowed before and behind in such a manner that the general form of the body, leaving out of consideration the external appendages, approaches an oval; nevertheless the narrowed anterior part of the body is shorter and more rounded, whilst the hinder part appears more drawn out. The skin has a general light brownish-yellow colour, with dark-brown marks (*plaques*) distributed singly over the whole surface of the body; these acquire the most various forms, and possibly represent the secretion produced by the cutaneous glands. At no part is there a transverse segmentation of the body indicated by external furrows. The segmentation, however, is sufficiently indicated by the external appendages, according to which the entire body is divisible into 18 segments. The cephalic segment (see Pl. I. fig. 1), which at first sight almost presents a greater resemblance to that of a mollusk than to that of an annelid, is the longest of all; its somewhat truncated frontal margin presents in the middle a distinct but not deep notch forming the two lateral lobes of the head. On each lobe are seated two clavate tentacles—one placed more towards the upper surface, the other lower down towards the mouth; so that, in all, four cephalic or frontal tentacles are present—two superior, and two inferior. The bases of these, as also the space between them, are densely set with small papillæ, likewise more or less clavate, which are distinguished from the true tentacles by nothing but their smaller size; so that the tentacles, from their whole habit and when compared with the small papillæ surrounding them, might likewise be characterized as papillæ projecting, in consequence of especial development, from the midst of the numerous smaller but otherwise perfectly similar structures. But their constant occurrence on the above-mentioned spots on the head, their size, and mobility justify their receiving the denomination of tentacles.

Further back, at about half the length of the head, there are

* I have already made a brief communication upon this subject, at the Meeting of the Niederrheinischen Gesellschaft für Natur- und Heilkunde (Bonn) on the 8th February, 1866, where I also exhibited the drawings relating to it (Kölnische Zeitung, 31st March, 1866, No. 90).

two more tentacles, one on each side, which might be denominated posterior cephalic tentacles or *tentacular cirri*; so that we have in all six tentacles on the head—four anterior, and two posterior. The small clavate papillæ mentioned above as occurring in the spaces between the anterior tentacles, extend also into the region of the posterior tentacles, but are not so closely approximated, and from this point begin to change from the elongate clavate to a more globular form. I call attention at once to this change, as it indicates at the same time a change in the function of these cutaneous appendages, the anterior clavate appendages being, in my opinion, organs of touch, whilst the posterior globular ones are to be regarded as glands. The middle part of the cephalic segment bears two reddish-brown eyes, which are placed a little within the bases of the two lateral posterior tentacles. The segment of a spherical lens projects from each eye forward and outward.

The cephalic segment, as already remarked with regard to the segmentation in general, is not separated by any transverse furrow from the first segment of the body, but passes into it without any definite boundary. The first body-segment is therefore determined partly by the inferior setiferous pedal tubercles, and partly by the large globular cutaneous appendages which at this spot pass like a ring round the whole body. I say like a ring, and must call particular attention to this, because, singularly enough, these appendages are not only arranged transversely upon the dorsal surface between the two lateral rudimentary feet, but occupy the ventral surface also in the same manner*. As regards the number, however, there is a noticeable difference between those standing on the dorsal and ventral surfaces; for whilst on the back there are six of these globular bodies in a row, there are only four on the ventral surface. This condition, of course, tends greatly to suggest the notion that the two outer lateral processes situated upon the back over the pedal tubercles are to be regarded as the two true dorsal cirri. But the two lateral structures are perfectly similar to those standing in a row between them, both in size and form. As regards their function, moreover, there is no distinction; all, as we shall see hereafter, are glands. If, therefore, we were to call the two lateral processes dorsal cirri, this might also be required for the other similar appendages situated on the back, and, in the same way, we should also have to name the transverse rows situated on the ventral surface ventral cirri. It would be no obstacle to such a conception

* In *Sphærodorum peripatus*, as is well known, only one pair of these globular cutaneous appendages is situated upon each segment—one on each side of the back.

that all these appendages, as already stated, are glands; for the cirri of the Annelids in general are not to be regarded merely as organs of touch or motion, but may apparently be subservient to very various purposes*.

If we now examine these globular cutaneous appendages more closely, we observe, even with a low power, that their cavities are occupied by a coil of tortuous vermiform bodies, which Oersted † has already detected and described in the dorsal cirri of *Sphaerodorum*, and with regard to which he proposes the question whether they may not be ovaries. These peculiar structures seem to have entirely escaped Johnston ‡, which I can only explain by supposing that he did not examine them in a fresh state; for if the animals under examination be dead, or if they have been exposed for some time to pressure for the purpose of observation, nothing remains of the original appearance, in consequence of the breaking up of the vermiform bodies. Johnston regards the globular appendages in *Sphaerodorum* (*Pollicita peripatus*) as branchiæ. To Claparède belongs the merit of having first more accurately grasped the morphological nature, although he could not arrive at any definite opinion as to the physiological signification of these organs. He thought that he could see an orifice § in the papilliform process which occurs on the upper part of the globular dorsal cirri in *Sphaerodorum*, but not in our animals, but found that the capsule was closed in other respects; in this, however, as Kölliker has proved, he was in error.

Kölliker|| first placed their histological and by that means also their physiological character in the proper light, when he found that the papilliform process in *Sphaerodorum* is not perforated, but that each of the vermiform bodies situated in the interior of the capsule opens externally by an orifice of its own. He regards the individual bodies as *tubular glands*, which "apparently consist entirely of rounded-angular, dark, cell-like structures."

As regards my own observations, I have but little to add to Kölliker's statements in relation to the structure of these organs. The mammilliform process occurring upon the capsules in *Sphaerodorum* is entirely wanting in our animals; so that I can express no opinion as to the perforation which Claparède describes, but, according to Kölliker, has no existence; I can, however, completely confirm Kölliker's results, according to which each of

* See Ehler's 'Die Borstenwürmer,' p. 22.

† "Zur Classification der Annulaten," Wiegmann's Archiv, 1844, p. 108.

‡ 'Annals,' vol. xvi. p. 5, pl. 2.

§ Beobacht. über Anat. der wirbell. Thiere, p. 21, taf. 11. figs. 12, 13.

|| Würzb. naturw. Zeitschrift, 1864, p. 240, taf. 6. fig. 1.

the tubular glands opens externally by a separate orifice (Pl. I. figs. 10-14).

With regard to the contents of the individual tubes, these frequently consist of densely compressed, small, more or less roundish, sharply defined corpuscles: these were seen by Claparède; and Kölliker, as already stated, calls them "cell-like structures." Even by the employment of high powers I could detect no nucleiform structures, or anything of the sort, in the individual corpuscles.

Kölliker's interpretation of the structures in question as tubular glands is the only admissible one; it is especially founded on the above-mentioned opening of each tube separately at the external surface.

Thus (to return to the description of our little animal) we have ten of these large globular glandular capsules surrounding the periphery of the first segment of the body, and that of each following one, in two transverse rows, one on the dorsal, the other on the ventral surface. It is only on the last segments that the number diminishes by one or two capsules in each row. Between the regular rows of these large cutaneous appendages there are distributed over the whole surface of the body a very great number of irregularly arranged smaller but likewise globular capsules, the size of which varies greatly among themselves. They all, like the above-described larger structures, represent cutaneous glands; and by their careful examination we may, it appears to me, carry out the very interesting observation of the complete development of the glandular bodies in question. I have figured some of the principal forms and stages of development, so far as the limited material permitted this to be done (Pl. I. figs. 3-9). The first (and smallest) of these forms (fig. 3) represents a vesicle of only 0.009 millim. in diameter, in the interior of which a tolerably sharply marked compact nucleus is situated: there are often two, or even three of these nuclei; but one of them is usually remarkable for its size. A further-advanced form (fig. 4) shows the vesicle enlarged to nearly double the diameter, as also the enclosed nucleus, which has also become filled with a finely granular substance. This type is also retained by the following stage, except that the granular substance of the nucleus becomes more dense, and some granules shine out of it like dimly lustrous globules. When a certain size has been attained, a roundish perforation of the nuclear substance itself takes place at some spot, usually near the periphery of the nucleus, so that the nucleus appears as if pierced at this point. This first hole is often followed by a second in close juxtaposition with it. As this opening enlarges, the bridge situated towards the peri-

phery, corresponding with the narrowest border of the orifice, breaks through, and the two ends then separate from each other; so that instead of the round hole in the nuclear substance we have a deep indentation of the nuclear substance penetrating from the circumference towards the middle. By this simple process therefore, as may be readily seen, the form of the above-mentioned glandular tube is very soon produced: at first, by the two ends becoming rounded, it has nearly the appearance of a sausage with two surfaces in apposition; and it frequently retains this form even in the fully developed state. But generally, during the further growth of the tube, its two extremities separate more or less, and then one of them becomes bent or rolled up, so as even to embrace the neighbouring tubes; and thus the position and form of the individual glands is altered in many ways, and the above-described appearance of the vermiform, tortuous, glandular coil as the contents of the capsule is produced.

As regards the further histological differentiation of the individual glandular tubes, these, during the processes just described, become more and more filled with darkly granular substance, in which afterwards larger pale bodies make their appearance; these gradually increase, until finally the whole tube is filled with the roundish corpuscles, or, as Kölliker calls them, cell-like structures, above described. The perfectly formed glandular tube is attached by one end, or frequently, as it seemed to me, by both ends, to the wall of the capsule; but only one extremity, and with it the wall of the capsule at the same spot, exhibits a roundish external orifice.

The number of glands enclosed in a capsule is not constant. The above-mentioned large capsules standing in regular transverse rows generally contain three or four, rarely more (figs. 10 to 14); the smaller only one, or, at the utmost, two tubes.

On various parts of the surface of the body, partly upon and partly between the vesicles, and sometimes even within them, we frequently see dark-brown marks (*plaques*), forming the most multifarious figures, which are often, in consequence of their tenacious consistence, much elongated, and only connected by narrow bridges. These substances appear to have nothing to do with the pigment-structures which so frequently occur in the skin of Annelids; but whether they are, as I suppose, to be regarded as the secretion furnished by the glands, and what purpose is served by it in this case, I cannot decide.

I have already called attention to the gradual transition from the small clavate cutaneous structures, resembling the tentacles which stand upon the anterior portion of the head, to the globular ones which succeed them, and indicated that a change of func

tion is connected with the change of form. This opinion is founded upon the circumstance that in the small papillæ of the cephalic segment I have never detected structures resembling the above-described developmental stages of the glands, or the latter with their openings. On the other hand, it appeared to me that fine filaments penetrated into some of them from below, and passed at the top into granular inflations: these therefore might be regarded as the extremities of nerves. I believe, therefore, that these small papillæ of the cephalic segment are to be regarded as tactile organs, in contradistinction to the globular appendages seated upon the rest of the body, which, as already shown, are cutaneous glands. With reference to *Sphærodorum*, Kölliker remarks that the (whole of the) small papillæ of the skin are not pierced by glands, but contain nerve-terminations—in direct contradiction to Claparède, who found the papillæ of the entire surface of the skin pierced by the efferent ducts of small cutaneous glands in the same animal. As I have at my disposal only a few spirit-specimens of *Sphærodorum*, collected last summer in Heligoland, I cannot decide upon this difference, or whether the above-described distinction between tactile and glandular papillæ exists also in *Sphærodorum*.

Besides the described circle of globular glandular capsules (or, if it be preferred, the transverse rows of dorsal and ventral cirri), each segment also bears a pair of uniramose pedal tubercles. Each foot (fig. 2) consists of a conical tubercle, at the apex of which there is a pair of lamellar processes or fins and a bundle of about six composite setæ inserted into the tubercle; posteriorly the number of the latter diminishes, so that on the last segments there are only one or two setæ in each tubercle; but these are exactly similar to those of the anterior feet. The pedal tubercles are placed directly beneath the two lateral dorsal capsules, and are usually in part concealed by them.

The alimentary apparatus of our animal commences with a buccal orifice placed on the lower surface of the cephalic segment, towards the anterior margin; this, when retracted, resembles a funnel with numerous folds. The mouth leads at once into a spacious flask-shaped œsophagus (fig. 1) or gizzard with double walls, or rather consisting of two chambers placed to a certain extent one within the other. By compression, the inner part can be pushed out; but whether it can be voluntarily extended, and is consequently to be regarded as a trunk, I was unable to determine by observation. The œsophagus is directly followed, and, indeed, embraced, by a rather wide, dark-brown intestine, which lies loose in the body-cavity without any attachments or constrictions, and makes about four or five convo-

lutions before reaching the anus, which is situated at the posterior extremity of the body.

With regard to the sexual conditions, I can only state that one of the animals examined I found filled pretty closely with roundish discoid ova, which lay perfectly loosely and irregularly in the body-cavity, and, surrounding the intestine on all sides, were driven to and fro in the cavity of the body by the movements of the intestine and the general movements of the animal.

If we now glance back at the zoological characters of our animal, especially in comparison with those of the genus *Sphærodorum*, we shall be at once struck by certain points common to both. The most prominent of these are the globular cutaneous appendages occupied by glands, and the form of the cephalic segment, with its peculiarly formed tentacles and papillæ. Further points of union are presented by the form and composition of the feet, which in both consist of simple conical fins having a bundle of composite setæ. *Ærsted** indeed ascribes to *Sphærodorum* a multifid fin (*pinna unica multifida*); but this notion, as *Claparède* correctly observes, has evidently arisen from the fact that *Ærsted* regarded the glandular appendages which are frequently seated upon the pedal tubercles as parts or branches of the fin. Besides these characters, the two have in common the absence of any external segmentation of the body, or annulation of it by means of transverse furrows, as also, in connexion with this, no internal constrictions of the intestine are present, but the latter in both constitutes a loose tube laid together in several convolutions.

When we consider those properties of our animal which remove it from *Sphærodorum*, we find, in the first place, that whilst *Sphærodorum* bears *only one pair* of the large globular cutaneous appendages upon the back of each segment, in our animal *ten of these stand upon each segment*—six on the back, and four on the ventral surface. There is also a difference in the form of these appendages; for in *Sphærodorum* there is a papilliform process upon the globular capsule, whilst in our animal, in which this process is deficient, the globular form of the structures in question is much more clearly shown. In the presence and even the form of the four frontal tentacles of the buccal segment both agree; but we have described two posterior tentacles or tentacular cirri, exactly like the frontal tentacles, which are wanting in *Sphærodorum*, where their place is taken by two mere rudimentary glandular appendages.

Of subordinate distinctions we find that in our animal there are at the apices of the pedal tubercles two lamellar fins, which are absent in *Sphærodorum*; whilst, on the other hand, the

* *Loc. cit.* p. 108.

peculiarities which Claparède describes in the feet of some of its segments (the third, fourth, &c.) are wanting in our animal. Further, according to the statements of all authors, *Sphærodorum* has four eyes, whilst our animal only shows two. The accordance of the true intestine has already been pointed out; but we find essential differences in the anterior part of the alimentary tube, as in *Sphærodorum* this consists of three successive divisions (see Claparède, *Anat. &c.*, p. 51), which cannot be made to agree with the structure of the œsophagus &c. described by us.

Lastly, as regards the external form of the body in general, this, again, is extremely different in the two animals. Ærsted says of *Sphærodorum*, “*corpus lineare teretiusculum;*” Johnston, “*body serpentiform;*” and, lastly, Claparède describes *Sphærodorum* as a cylindrical worm of 2 inches long. If we contrast with this the little animal above described, scarcely 2 millims. in length, and comparatively very broad and nearly oval, the difference becomes very striking.

Nevertheless, notwithstanding all these differences, the affinities first indicated lead me to prefer uniting our animal, at least provisionally, with *Sphærodorum* to form a single genus, for which purpose, however, the generic characters given by Ærsted and others must undergo some modifications. I would define the genus as follows:—

Genus SPHÆRODORUM, Ærsted.

The more or less elongated body, which is always narrowed before or behind, nowhere shows any transverse annulation or segmentation indicated by external furrows, although this is defined by the outer appendages. The buccal segment bears on the anterior margin of the small and not deeply divided cephalic lobes four clavate and anteriorly somewhat inflated frontal tentacles, the bases of and intervals between which are closely set with small but also clavate papillæ. Further back, likewise on the buccal segments, there are two tentacular cirri, one on each side, which sometimes resemble the frontal tentacles, and in this case are to be regarded as true tentacles also in respect of their function, sometimes in form and signification approach the globular cutaneous appendages of the following segments, and must then pass as glandular organs. The first body-segment and all the following ones are characterized by large globular cutaneous appendages occupied by tortuous tubular glands. Of these either each segment bears only two upon its back, namely, one on each side over the pedal tubercle (dorsal cirri), or the whole segment is surrounded by a circlet

of these appendages, which are placed at regular intervals, and form a transverse row upon the back and another on the belly. Between the large cutaneous appendages there are numerous small ones irregularly scattered over the body. Feet simple, containing a bundle of composite setæ.

1. *Sphærodorum flavum*, Ørst.

Annulat. Danicor. Conspectus, fasc. i. p. 43, pl. 1. fig. 5, pl. 6. figs. 92, 101. Archiv für Naturg. 1844, i. p. 108.

Corpore $1\frac{1}{2}''$ longo, $\frac{3}{4}'''$ lato, teretiusculo, flavescente, utrinque fere æqualiter attenuato, segmentis 150, duplo latioribus quam longis, papillarum 12–16 in margine anteriore capitis, duabus paulo longioribus; oculis quatuor quadratum formantibus; pinnis abbreviatis, 7–8-fidis, setis 5–7 uncinatis.

The preceding character of Ørsted's species must certainly undergo some alterations in accordance with the above observations. As, however, *S. flavum* does not appear to have been observed by any one since Ørsted, I leave his description unaltered for the present. It is possible, moreover, that there is no specific difference between *S. flavum* and *S. peripatus*.

2. *Sphærodorum peripatus*, Grube.

(Die Familien der Anneliden, p. 67.)

Pollicita peripatus, Johnston, Ann. Nat. Hist. vol. xvi. p. 5, pl. 2. figs. 1–6.

Sphærodorum peripatus is the species investigated by Claparede and Kölliker, as has already been repeatedly stated.

3. *Sphærodorum Claparedii*, sp. n. Pl. I.

I venture to name the new species described in detail in this paper after the indefatigable observer who has done so much for the natural history of the Annelida.

EXPLANATION OF PLATE I.

Fig. 1. *Sphærodorum Claparedii*, magnified about 40 diameters.

Fig. 2. Foot with the bundle of composite uncini, magnified 300 diameters.

Figs. 3–9. Developmental stages of the glandular appendages, magnified about 600 diameters.

Figs. 10–14. Developed glandular capsules with the tubes contained in them, and opening externally by a fine orifice in the wall of the capsule; magnified about 600 diameters.